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EFFECT OF RANGE DIMENSIONS ON WAKE STUDIES

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The following is a brief description of an apparent anomaly observed during some recent wake studies conducted by Robert Reynolds in the Hypervelocity Ballistics Range of Ames Research Center, NASA.

Figure 1 shows the general configuration of the range and the location of measurement stations for ultraviolet radiation, infrared radiation, and microwave interference from the wake. The first station is located in a 19-inch-diameter tube 16 feet from the gun muzzle. The second station is located farther downstream in the main testing tank, which is 8 feet in diameter and was instrumented for infrared radiation only.

The models used were 20-mm round-nosed cylindrical shapes of high-density polyethylene, launched at a nominal velocity of 20,000 ft/sec into still air at static pressures of between 2 and 7 mm of mercury.

Figure 2 shows the infrared radiation measured at the two stations. These traces are not of the same shot; however, both shots were made at static pressures of 7 mm of mercury. The traces in this figure are not photographic duplicates of the records but have been sketched from the actual traces recorded from an oscilloscope. Note that in both stations the initial traces are similar in that after a sudden increase there is a slight dropping off of radiation and then a momentary hold. The first station shows more of a subsequent drop in radiation than does the second station. The trace obtained at the first station in the small tank shows a large increase in radiation after the passage of the model. At the lowest test pressures, 2 mm of mercury, there was no increase in radiation after the passage of the model. The ultraviolet and microwave detectors also showed a similar variation in output after the passage of the model at the higher test pressures, similar to the variation of infrared radiation shown previously.

Schlieren photographs were taken of the wake at the microwave station. The pictures show what appears to be waves from some exterior source interfering with the wake at the time of the increase in radiation.

There are a number of possible sources of these waves. Wave diagrams based upon model velocity and position superimposed on the configuration of the test chamber show that it is possible for waves to be reflected from the end of the tank or from the side walls impinging on the wake at the times observed. Another possible source of interference is the gun blast, although it would seem likely that such interference would be worse at the lower test pressures. None of these sources should cause interference at the measurement station in the large tank.

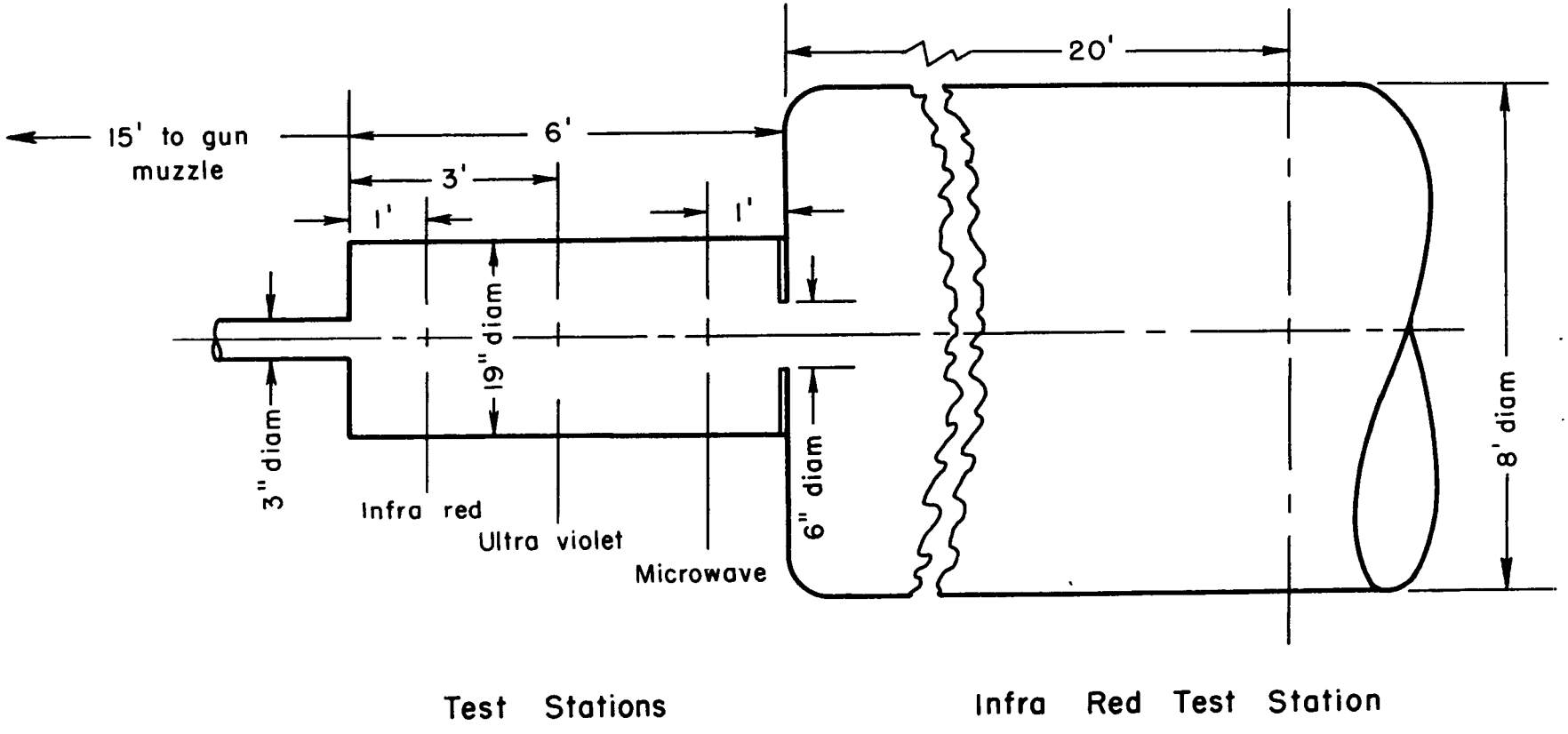

Figure 1.- General arrangement of range for wake studies.

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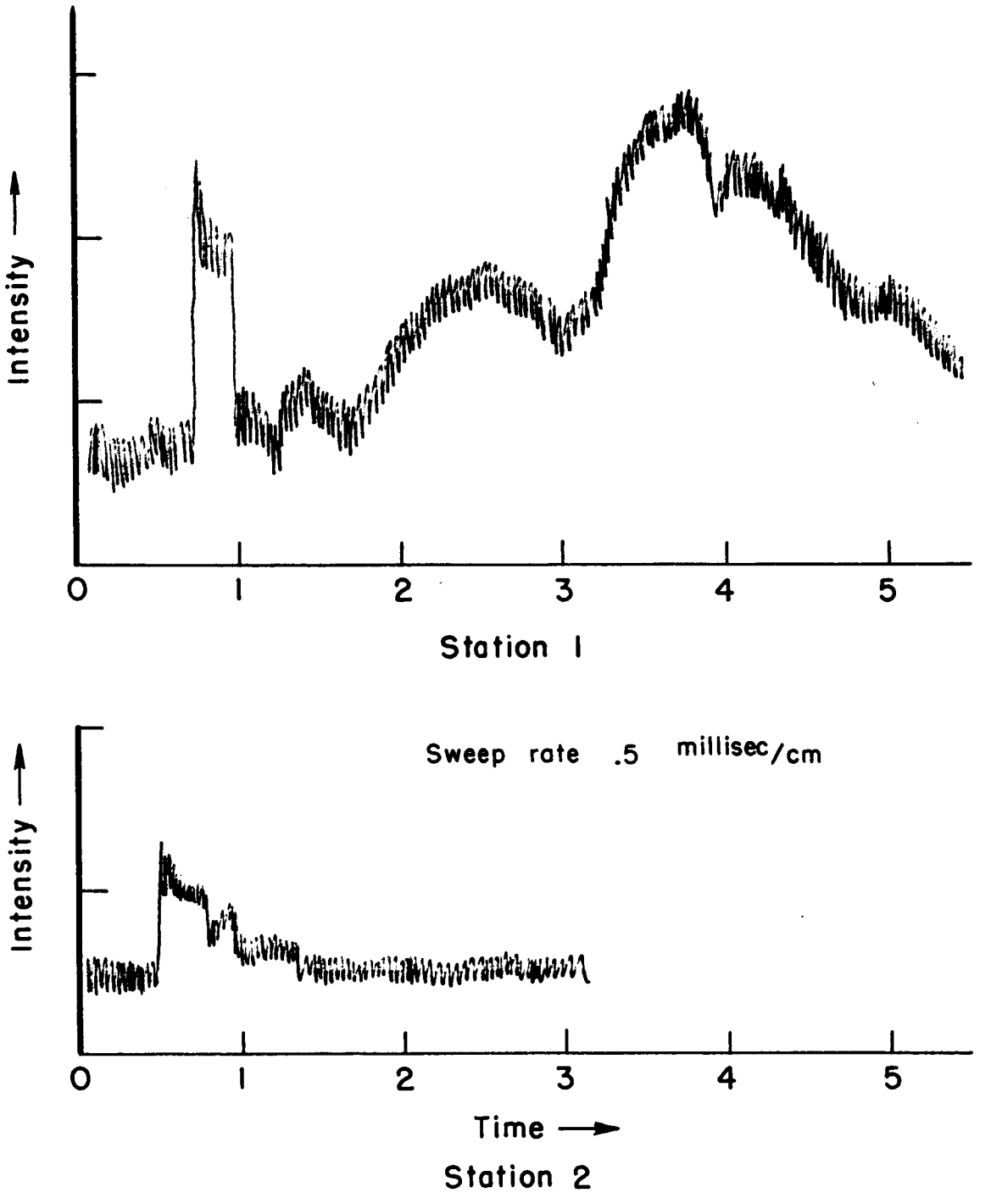

Figure 2.- Infrared radiation traces.

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